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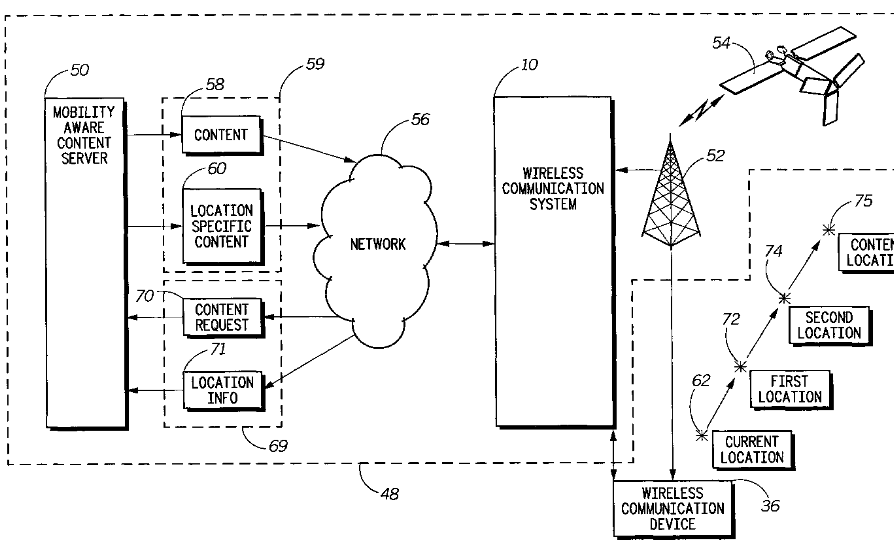
(54) Title: COMMUNICATION MANAGEMENT SYSTEM FOR PERSONALIZED MOBILITY MANAGEMENT OF WIRELESS SERVICES AND METHOD THEREFOR



(57) Abstract: A communication management system (48) for personalized mobility management of wireless services includes at least one wireless communication device (36), a mobility aware content server (50), and a wireless communication system (10). The mobility aware content server (50) sends a location specific content (60) to the wireless communication system (10) in response to a current location (62), a movement speed (64), and a movement direction (66) of the wireless communication device (36). The wireless communication system (10) is coupled to the mobility aware content server (50), and, upon receipt of the location specific content (60) from the mobility aware content server (50), transmits the location specific content (60) to the wireless communication device (36).

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COMMUNICATION MANAGEMENT SYSTEM FOR PERSONALIZED MOBILITY MANAGEMENT OF WIRELESS SERVICES AND METHOD THEREFOR

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates in general to wireless communication systems and in particular to wireless communication systems for personalized mobility management of wireless services

Description of the Related Art

With the advent of information services for wireless communication devices such as one and two-way pagers and cellular telephones, a device user may carry a device capable of receiving and accessing a large volume of data. Additionally, with improved memory capability of the wireless communication devices, the device can store a large volume of messages.

It is useful in many wireless communication systems, for example paging and cellular systems, to know the location of the wireless communication devices that are operating within the wireless communication system. The location or position information of the wireless communication devices for example can be used for registration and directed delivery of messages to the wireless communication devices or to locate a device user in case of an emergency situation.

Conventional schemes for locating wireless communication devices determine only a current location for the wireless communication device. For example, a conventional wireless communication system can use direction-finding equipment at each base station site in order to fix the location of the wireless communication device. The current location is computed by triangulation when two or more transmitter base stations receive the same signal. The disadvantage to this system is that the wireless communication

device is required to transmit for long time periods at high power levels in order to enable accurate measurements of angles by the transmitter base stations. Such high power and long duty cycle transmissions would not be effective for small wireless communication device applications such as two way pagers and cellular telephones due to the battery life loss.

As part of a wireless communication service, there are adjunct servers that provide information and other content services to device users that have their content configured according to personalized preferences, system generated information, and the wireless communication device generated information. Location based services are typically application limited due to the hardware, software, and networks required to support the ability to locate a mobile object and then communicate the unit's location back to a control point where the location information is utilized by a server. The server provides location based functions based on the needs of the particular application.

The most common location based applications prior to the integration of sophisticated location system data becoming available in wireless communication devices include vehicle fleet management (location of trucks, speed, direction, in/out of bounds, off route, traffic/accident avoidance, stolen vehicle recovery), asset tracking (used primarily for large freight containers, container location, customer delivery information), maps (a useful location based service is the delivery of maps for finding streets, addresses, businesses, location information is supplied by the system about the user's position and then this information is utilized to send the appropriate maps of the area), and localized information services (information services optimized for a location, cell or regional basis, cellular or paging, weather, traffic, events, now becoming specialized to restaurants, shopping, services).

Additionally, the recent introduction of content information services provides a new method of communicating a large amount of information to a large number of people at a relatively low cost. However, content information may be relevant only to a device user who either has entered or is about to enter a certain location, and not relevant when the user is located elsewhere.

What is needed is a wireless communication system and method for selecting relevant content information from the large amount of communicated content information on the basis of a future location of the device user. . What is further needed is a system and method to dynamically update position and time information in order to make a judgment on the direction and speed of the mobility of the device user by sampling the position at different intervals. Once the system understands this location, speed and direction, its services can be tailored accordingly.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is an electronic block diagram of a conventional wireless communication system;

FIG. **2** is an electronic block diagram of a communication management system for personalized mobility management of wireless services in accordance with the present invention;

FIG. **3** is an electronic block diagram of a wireless communication device for use in the communication management system of FIG. **2**;

FIG. **4** is an electronic block diagram of a mobility aware content server for use in the communication management system of FIG. **2**;

FIG. **5** is a flowchart illustrating the operation of the mobility aware content server of FIG. **4** in accordance with the present invention;

FIGs. **6** and **7** illustrates various protocols for communication within the communication management system of FIG. **2**;

FIG. **8** is a flowchart illustrating one embodiment of the operation of the communication management system of FIG. **2**;

FIG. **9** illustrates a mobile vehicle for use within the communication management system of FIG. **2**; and

FIG. **10** illustrates a protocol for communication within the communication management system of FIG. **2** using the mobile vehicle of FIG. **9**.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **1**, an electronic block diagram of a wireless communication system **10** is shown. The wireless communication system **10** comprises a message input device, such as a telephone **12**, a computer **14**, or a desktop messaging unit **16**, connected through a conventional public switched telephone network (PSTN) **18** through a plurality of telephone links **20** to a mobile system controller **22**. The telephone links **20** may be a plurality of twisted wire pairs, a fiber optic cable, or a multiplexed trunk line.

The mobile system controller **22** is coupled to and oversees the operation of at least one radio frequency (RF) transmitter **26** and at least one radio frequency (RF) receiver **28** through one or more communication links **24**. The communication links **24** typically are twisted pair telephone wires, and additionally can include radio frequency (RF), microwave, or high quality audio communication links. The radio frequency transmitter **26** and the radio frequency receiver **28**, which typically are used in message store and forward stations that encode and decode inbound and outbound messages into formats that are compatible with landline message switch computers and personal radio addressing requirements, such as cellular message protocols. The mobile system controller **22** can also function to encode and decode wireless messages that are transmitted to or received by the radio frequency transmitter **26** or the radio frequency receiver **28**. Telephony signals are typically transmitted to and received from the mobile system controller **22** by telephone sets such as the telephone **12** or a wireless communication device **36**. The mobile system controller **22** encodes and schedules outbound messages such as a downlink message **34**, for transmission by the radio frequency transmitter **26** via a transmit antenna **30** to at least one wireless communication device **36** on at least one outbound radio frequency (RF) channel **32**. As illustrated in FIG. **1**, the wireless communication device **36** may be, for example, a cellular telephone or a two-way pager. The downlink message **34** may be, for example, a data message. Similarly, the mobile system controller **22** receives and decodes inbound messages such as an

uplink message **44** received by the radio frequency receiver **28** via a receive antenna **40** on at least one inbound RF channel **42** from the wireless communication device **36**. The uplink message **44** may be, for example, a data message or a reply to a data message.

It will be appreciated that the wireless communication system **10**, in accordance with the present invention, may function utilizing any wireless RF channel, for example, a one or two-way pager channel, a mobile cellular channel, or a mobile radio channel. Similarly, it will be appreciated that the wireless communication system **10** may function utilizing other types of channels such as infrared channels. In the following description, the term wireless communication system refers to any of the wireless communication systems mentioned above or an equivalent.

Similarly, it will be appreciated that the wireless communication device **36**, in accordance with the present invention, may be a mobile cellular telephone, a mobile radio data terminal, a mobile cellular telephone having an attached data terminal, or a two-way pager. In the following description, the term "wireless communication device" refers to any of the devices mentioned above or an equivalent.

Each wireless communication device **36** assigned for use in the wireless communication system **10** has an address **38** assigned thereto which is a unique selective call address in the wireless communication system **10**. The address **38** enables the transmission of the downlink message **34** from the mobile system controller **22** only to the wireless communication device **36** having that address **38**, and identifies the messages and responses received at the mobile system controller **22** from the wireless communication device **36**. In one embodiment, each wireless communication device **36** also has a pin number assigned thereto, the pin number being associated with a telephone number within the PSTN **18**. A list of the assigned addresses and correlated telephone numbers for each wireless communication device **36** is stored in the mobile system controller **22** in the form of a subscriber database **46**.

Referring to FIG. **2**, an electronic block diagram of one embodiment of a communication management system **48** for personalized mobility management of wireless services in accordance with the present invention is shown. The communication management system **48**, as illustrated in FIG. **2** includes the wireless communication system **10**, a mobility aware content server **50**, a radio tower **52**, and a satellite **54**.

As illustrated in FIG.**2**, the mobility aware content server **50** is coupled to the wireless communication system **10** via a network **56**. The network **56**, for example, can be a local area network or a wide area network. The mobility aware content server **50** controls and manages communication of a plurality of content information **58** to a plurality of wireless communication devices such as the wireless communication device **36** of FIG. **1**. The mobility aware content server **50**, determines a plurality of location specific content **60** to be sent to the wireless communication device **36** in response to a current location **62**, a movement speed **64**, and a movement direction **66** of movement of a device user **68** in possession of the wireless communication device **36** by sending the location specific content **60** through the wireless communication system **10** to the wireless communication device **36**. The wireless communication system **10**, upon receipt of the location specific content **60** from the mobility aware content server **50**, transmits the location specific content **60** to the wireless communication device **36** preferably as the downlink message **34** via the outbound RF channel **32** as illustrated previously in FIG. **1**. Further, the wireless communication system **10** communicates a server input **69** to the mobility aware content server **50** in response to an event. For example, the wireless communication system **10** can communicate a server input **69** that is a content request **70** to the mobility aware content server **50** in response to receipt of the uplink message **44** from the wireless communication device **36** including the content request **70**. Similarly, the wireless communication system **10** can communicate a server input **69** that is a location information **71** in response to receipt of the uplink

message **44** from the wireless communication device **36** including the location information **71**.

The addition of the mobility aware content server **50** to the communication management system **48** enhances the operation of the communication management system **48** by adding intelligence including device location, movement speed, and movement direction for the management of location specific content to the wireless communication device **36**.

The detection and notification of the current location **62**, the movement direction **66**, and the movement speed **64** of the wireless communication device **36** can be done by either the wireless communication device **36** itself, the wireless communication system **10**, or the mobility aware content server **50** using information received from the radio tower **52**. For example, in a wireless communication system using the ReFLEX protocol, each radio tower is assigned a 'Color Code', which is embedded in the frame synchronization word broadcasted to the plurality of wireless communication devices such as the wireless communication device **36**. The wireless communication device **36** can determine its relative location by comparing the current color code against an earlier color code. Similarly, in the GSM protocol, the Base Identification Code (BSIC) broadcasted on the SCH of every cell allows a mobile station to distinguish among neighboring cells. The movement direction **66** and the movement speed **64** are calculated using a plurality of received location points such as a first location point **72** and a second location point **74**.

Alternatively, the wireless communication system can use a very high-frequency omni directional range (VOR), which is used primarily as a navigation aid for aircraft compares the phase of a fixed and rotating signal to compute its angle with respect to a transmitter station. In a VOR system, a transmitter emits a (variable) modulation whose phase relative to a reference modulation is different for each bearing of the receiving point from the station. The typical radio frequency (RF) bandwidth required for a VOR system is around 25 kilohertz (KHz).

Alternatively, as illustrated in FIG. **2**, the current location **62** of the wireless communication device **36** can be determined using the Global Positioning System (GPS). The Global Positioning System is a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations. GPS uses these "man-made stars" as reference points to calculate positions accurate to a matter of meters. The satellites in space such as the satellite **54** are used as reference points for locations here on earth.

It will be appreciated by one of ordinary skill in the art that the communication management system **48**, in accordance with the present invention, can determine the location of the plurality of wireless communication devices using the systems mentioned above or an equivalent.

FIG. **3** is an electronic block diagram of a preferred embodiment of the wireless communication device **36** for use within the communication management system **48** of FIG. **2**. The wireless communication device **36** includes a first device antenna **76**, a second device antenna **78**, a device receiver **80**, a device transmitter **82**, a device processor **84**, a device memory **86**, an alert circuit **88**, a display **90**, a user interface **92**, a global positioning satellite (GPS) receiver **94** and GPS antenna **96**.

The first device antenna **76** intercepts transmitted signals from the wireless communication system **10**. The first device antenna **76** is coupled to the device receiver **80**, which employs conventional demodulation techniques for receiving the communication signals transmitted by the wireless communication system **10** such as the downlink message **34** of FIG. **1**.

Coupled to the device receiver **80**, is the device processor **84** utilizing conventional signal processing techniques for processing received messages. Preferably, the device processor **84** is similar to the MC68328 micro-controller manufactured by Motorola, Inc. of Schaumburg, Illinois. It will be appreciated by one of ordinary skill in the art that other similar processors can be utilized for the device processor **84**, and that additional processors of the same or

alternative type can be utilized as required to handle the processing requirements of the device processor **84**.

The device processor **84** decodes an address in the demodulated data of the received message, compares the decoded address with one or more addresses such as the address **38** stored in an address memory **98** of the device memory **86**; and when a match is detected, proceeds to process the remaining portion of the received message.

To perform the necessary functions of the wireless communication device **36**, the device processor **84** is coupled to the device memory **86**, which preferably includes a random access memory (RAM), a read-only memory (ROM), and an electrically erasable programmable read-only memory (EEPROM)(not shown). The device memory **86** also includes the address memory **98**, a content memory **100** and a message memory **102**.

Once the device processor **84** has processed a received message, it stores the decoded message in the message memory **102**. It will be appreciated by one of ordinary skill in the art that the message memory **102**, in accordance with the present invention, can be a voicemail box or a group of memory locations in a data storage device. In the following description, the term "message memory" refers to any of the memory means mentioned above or an equivalent.

Upon receipt and processing of a message, the device processor **84** preferably generates a command signal to the alert circuit **88** to notify the device user **68** (see FIG. **2**) that the message has been received and stored. The alert circuit **88** can include a speaker (not shown) with associated speaker drive circuitry capable of playing melodies and other audible alerts, a vibrator (not shown) with associated vibrator drive circuitry capable of producing a physical vibration, or one or more LEDs (not shown) with associated LED drive circuitry capable of producing a visual alert. It will be appreciated by one of ordinary skill in the art that other similar alerting means as well as any combination of the audible, vibratory, and visual alert outputs described can be used for the alert circuit **88**.

Upon receipt of a message, the device processor **84** preferably also generates a command signal to the display **90** to generate a visual notification of the receipt and storage of the message. When the display **90** receives the command signal from the device processor **84** that the message has been received and stored in the message memory **102**, a message indication is displayed. The message indication, for example can be the activation of one of a plurality of message icons on the display **90**. The display **90** can be, for example, a liquid crystal display utilized to display text. It will be appreciated by one of ordinary skill in the art that other similar displays such as dot matrix displays can be utilized for the display **90**.

Preferably, the user interface **92** is coupled to the device processor **84**, as shown in FIG. 3. The user interface **92** can be one or more buttons used to generate a button press, a series of button presses, a voice response from the device user **68**, or some other similar method of manual response initiated by the device user **68** of the wireless communication device **36**. The device processor **84** is responsive to commands generated by the device user **68** via the user interface **92**.

The device transmitter **82** is coupled to the device processor **84** and is responsive to commands from the device processor **84**. When the device transmitter **82** receives a command from the device processor **84**, the device transmitter **82** sends a signal such as the uplink message **44** via the second device antenna **78** to the wireless communication system **10**.

In an alternative embodiment, the wireless communication device **36** includes one antenna performing the functionality of the first device antenna **76** and the second device antenna **78**. Further, the wireless communication device **36** alternatively includes a transceiver circuit performing the functionality of the device receiver **80** and the device transmitter **82**. It will be appreciated by one of ordinary skill in the art that other similar electronic block diagrams of the same or alternate type can be utilized for the wireless communication device **36** to handle the requirements of the wireless communication device **36**.

The wireless communication device **36** of FIG. **3** preferably includes the GPS receiver **94** and GPS antenna **96**. The GPS receiver **94** uses the satellites in space as reference points for locations here on earth. The GPS receiver **94** measures distance using the travel time of radio signals. The GPS receiver **94** has very accurate timing to measure travel time. Along with distance, the GPS receiver **94** knows exactly where the satellites are in space. Finally the GPS receiver **94** corrects for any delays the signal experiences as it travels through the atmosphere.

The GPS receiver **94** receives a plurality of signals via the GPS antenna **96** corresponding to the current location **62**. Preferably, the current location **62**, determined from the processing of the plurality of signals, is stored in the device memory **86** for later use. The GPS receiver **94** provides an accurate method for the wireless communication device **36** to determine its current location **62**.

FIG. **4** is an electronic block diagram of a preferred embodiment of the mobility aware content server **50** for use in the communication management system of FIG. **2**. The mobility aware content server **50** includes a server processor **112**, a server content memory **114**, a server user memory **116** and a server monitor **118.**

The first server antenna **104** The first server antenna **104** is coupled to the server receiver **106**, which employs conventional demodulation techniques for receiving the communication signals transmitted by the wireless communication system **10** such as the content request **70.**

The server processor **112** intercepts signals such as the server input **69,** which can be for example the content request **70** or the location information **71**, from the wireless communication system **10** received via the network **56.** The server processor **112** also sends the content information **58** such as the location specific content **60** to the wireless communication system **10** via the network **56.**

The server processor **112** utilizes conventional signal-processing techniques for processing received content requests. Preferably, the server

processor **112** is similar to the MC68328 micro-controller manufactured by Motorola, Inc. of Schaumburg, Illinois. It will be appreciated that other similar processors can be utilized for the server processor **112**, and that additional processors of the same or alternative type can be added as required to handle the processing requirements of the server processor **112**. The server processor **112** receives the content request **70** from the server receiver **106** and processes that request to generate the location specific content **60**.

To perform the necessary functions of the mobility aware content server **50**, the server processor **112** is coupled to the server content memory **114**, which preferably includes a random access memory (RAM), a read-only memory (ROM), and an electrically erasable programmable read-only memory (EEPROM). The server content memory **114** preferably stores a plurality of content information **120** including the content information **122**. The content information **122** is location specific and can be, for example local restaurants, local movies, local stores, or local weather. In the following description, the term content information refers to any of the content information mentioned above or an equivalent.

To perform the necessary functions of the mobility aware content server **50**, the server processor **112** is further coupled to the server user memory **116**, which preferably includes a random access memory (RAM), a read-only memory (ROM), and an electrically erasable programmable read-only memory (EEPROM). The server user memory **116** preferably stores location information for a plurality of device users. For example, the server user memory **116** stores a plurality of locations **124** for a first user. The server processor **112** is programmed to calculate a first user content location **126** using the plurality of locations **124** for the first user. The first user content location **126** is then stored in the server user memory **116** for later use by the mobility aware content server **50** to determine the location specific content **60** to send in response to a content request by matching the first user content location **126** with the plurality of content information **120**.

The server processor **112** is coupled to the server monitor **118**. The server monitor **118** performs various functions relating to the plurality of content information **120**. The server monitor **118** is preferably programmed with a set of rules regarding the substance of content information. The server monitor **118**, for example, may delete content information substance containing obscenity. The server monitor **118** may also disallow the creation of a new content containing obscenity. The server monitor **118** preferably also tracks traffic from a particular requester or group for billing purposes. Various billing methods are supported for the various types of content information. A flat rate per month, for example, may be charged to allow the device user **68** to pick a certain number of content information to subscribe to continuously or as desired. Alternatively, hourly charges or per character charges may be applied to requested content information. One skilled in the art will recognize that the mobility aware content server **50** in accordance with the present invention supports any of the billing methods mentioned above or an equivalent.

FIG. **5** is a flowchart illustrating the operation of the mobility aware content server **50** of FIG. **4** in accordance with the present invention. In Step **128**, the mobility aware content server **50** receives the server input **69** from the wireless communication system **10**. Preferably, the first server antenna **104** of the mobility aware content server **50** the server input **69** transmitted from the wireless communication system **10** over the network **56**. Next, in Step **130** the mobility aware content server **50** analyzes the server input **69** and determines if the server input **69** is the location information **71**. Preferably, the server receiver **106** demodulates the server input **69** using conventional demodulation techniques. The demodulated signal from the server receiver **106** is then processed by the server processor **112** using conventional signal-processing techniques. In Step **132**, when the server input **69** is the location information **71**, the mobility aware content server **50** processes the location information **71**. Preferably, the server processor **112** stores the location information **71** in the server user memory **116** for the

device user associated with the location information **71**. For example, the server user memory **116** stores a plurality of locations **124** for a first user. The server processor **112** is programmed to calculate a first user content location **126** using the plurality of locations **124** for the first user. The first user content location **126** is then stored in the server user memory **116** for later use by the mobility aware content server **50** to determine the location specific content **60** to send in response to a content request by matching the first user content location **126** with the plurality of content information **120.**

In Step **134**, when the server input **69** is not the location information **71**, the mobility aware content server **50** determines if the server input **69** is the content request **70**. Preferably, the demodulated signal from the server receiver **106** is then processed by the server processor **112** using conventional signal-processing techniques to determine if the server input **69** is the content request **70**. When the server input **69** is not the content request **70** the process ends. In Step **136**, when the server input **69** is the content request **70**, the mobility aware content server **50** processes the content request **70** by matching the location to the content. Preferably, the server processor **112** determines the required content information **122** for the device user originating the content request **70**. The server processor **112** accesses the server content memory **114** to obtain the content information **58** which is preferably the location specific content **60**, for example local restaurants, local movies, local stores, or local weather. In Step **138**, the mobility aware content server **50** sends the location specific content **60**. The server transmitter **110** receives a command from the server processor **112** including the content information **58** such as the location specific content **60**. When the server transmitter **110** receives the command from the server processor **112**, the server transmitter **110** sends the content information **58** such as the location specific content **60** via the second server antenna **108** to the wireless communication system **10**.

FIG. **6** illustrates one embodiment of a location protocol **140** for use in the communication of location information between the wireless

communication device **36**, the wireless communication system **10**, and the mobility aware content server **50**. The location protocol **140** is embedded within the uplink message **44** sent from the wireless communication device **36** to the wireless communication system **10** via the inbound RF channel **42**. (see FIG. **1**) The location protocol **140** is further embedded within the server input **69** sent from the wireless communication system **10** to the mobility content aware server **50** via the network **56**. (see FIG. **2**)

The location protocol **140** of FIG. **6** preferably includes the address **38**, a location control code **142**, and the location information **71**. The address **38** is a unique selective call address assigned to the wireless communication device **36** in the wireless communication system **10**. The address **38** identifies the messages and responses received at the mobile system controller **22** from the wireless communication device **36**. The location control code **142** is a unique control code indicating that the location information **71** for the wireless communication device **36** follows. Preferably, as illustrated in FIG. **6**, the location information **71** includes the current location **62**, the movement speed **64**, and the movement direction **66**. The location protocol **140** facilitates the communication of location and movement information between the wireless communication device **36**, the wireless communication system 10 and the mobility aware content server **50**, thereby enabling the calculation of a future location of the wireless communication device **36** by the mobility aware content server **50**.

FIG. **7** illustrates one embodiment of a content protocol **144** for use in the communication of the location specific content **60** between the wireless communication device **36**, the wireless communication system **10**, and the mobility aware content server **50**. The content protocol **144** is embedded within the downlink message **34** sent to the wireless communication device **36** from the wireless communication system **10** via the outbound RF channel **32**. (see FIG. **1**) The content protocol **144** is further embedded within the server output **59** sent to the wireless communication system **10** from the mobility content aware server **50** via the network **56**. (see FIG. **2**)

The content protocol **144** of FIG. **7** preferably includes the address **38**, a content control code **146**, a content request flag **148**, a content attached flag **150**, and the location specific content **60**. The address **38** is a unique selective call address assigned to the wireless communication device **36** in the wireless communication system **10**. The address **38** enables the transmission of the downlink message **34** from the mobile system controller **22** only to the wireless communication device **36** having that address **38**. The address **38** further identifies the messages and responses received at the mobile system controller **22** from the wireless communication device **36**. The content control code **146** is a unique control code indicating that the message being communicated relates to content information for the wireless communication device **36**.

The content request flag **148** identifies that a request for content information has been enabled. For example, the content request flag **148** can be set to "on" when the content request **70** is sent from the wireless communication device **36** to the wireless communication system **10** within the uplink message **44**. (see FIG. **1**). Further, the content request flag **148** can be set to "on" when the content request **70** is sent from the wireless communication system **10** to the mobility aware content server **50** within the server input **69**. The content request flag **148** can be set to "off" when the message does not include a content request.

The content attached flag **150** identifies that the location specific content **60** follows in the message. For example, the content attached flag **150** can be set to "on" when the content protocol **144** is within the server output **59** sent from the mobility aware content server **50** to the wireless communication system **10** via the network **56** (see FIG. **2**). Further, the content attached flag **150** can be set to "on" when the content protocol **144** is within the downlink message **34** sent from the wireless communication system **10** to the wireless communication device **36** via the outbound RF channel **32**. (see FIG. **1**)

FIG. **8** is a flowchart illustrating one method for the communication of the content request **70** and responding communication of the location specific

content **60** between the wireless communication device **36** and the mobility aware content server **50**. In FIG. **8**, the content protocol **144** of FIG. **7** is utilized for communication of the location specific content **60**. In Step **152**, the mobile system controller **22** of the wireless on-call communication system **10** (see FIG. **1**) receives the content request **70** for location specific content **60**. The device user via the wireless communication device **36** can initiate the content request **70**. The mobile system controller **22** of the wireless communication system **10** receives and decodes the content request **70** such as the uplink message **44** received by the radio frequency receiver **28** via the receive antenna **40** on at least one inbound RF channel **42** from the wireless communication device **36**. Alternatively, the device user can initiate the content request **70** via a message input device such as the telephone **12**, the computer **14**, or the desktop messaging unit **16**. The request is communicated through the PSTN **18** through the plurality of telephone links **20** to the mobile system controller **22**.

In Step **154**, the mobile system controller **22** communicates the content request **70** via the network **56** to the mobility aware content server **50**. In Step **156**, the mobility aware content server **50** processes the content request **70**. The server receiver **106** demodulates the content request **70**. Next, the server processor **112** processes the received content request. Next, in Step **158**, the server processor **112** determines the user identification such as the first user by processing the address **38** through a database lookup. In Step **158**, a counter is set to N=1. Next, in Step **160**, the server processor **112** compares the address **38** received within the content protocol **144** with the Nth user address. In Step **162**, when the address **38** does not match the address of the Nth user, the counter is incremented to N=N+1 and returns to Step **160** to continue checking for a match between the received address and the address of the Nth user. In Step **164**, when the received address matches the address of the Nth user, the server processor **112** determines the location specific content **60** to send in response to the content request by matching the Nth user content location **126** with the plurality of content information **120**

contained within the content memory **114**. Next, in Step **166**, the server transmitter **110** sends the location specific content **60** via the second server antenna **108** to the wireless communication system **10** in response to a command from the server processor **112**. In Step **168**, the mobile system controller **22** transmits the location based content **60** within the content protocol **144** using a downlink message **34** to the wireless communication device **36**.

FIG. **9** illustrates one example of the utilization of the present invention. In FIG. **9**, the wireless communication device **36** such as a vehicle wireless communication device **171** is connected within a mobile vehicle **170**. The mobile vehicle **170** includes a vehicle address **190** which is a unique selective call address in the wireless communication system **10**.The mobile vehicle **170** includes a plurality of vehicle status indicators **172** coupled to the wireless communication device **36**. The plurality of vehicle status indicators **172** can include, for example, a vehicle current location **174**, a vehicle speed **176**, a vehicle direction **178**, a vehicle temperature **180**, a vehicle fuel status **182**, and a vehicle engine status **184**. The vehicle wireless communication device **171** periodically checks each of the plurality of vehicle status indicator **172**. The vehicle wireless communication device **171** analyzes the plurality of vehicle status indicators **172** and responds thereto dependent upon the information received. For example, when the vehicle fuel status **182** is low, the wireless communication device **171** can respond thereto by transmitting a vehicle content request **186** via the inbound RF channel **42** to the wireless communication system **10**, wherein the wireless communication system **10** then sends the vehicle content request **186** to the mobility aware content server **50** via the network **56**.

FIG. **10** illustrates one embodiment of the vehicle content request **186**. As illustrated in FIG. **10**, the vehicle content request **186** can include the vehicle address **190**, the vehicle current location **174**, the vehicle speed **176**, the vehicle direction **178**, and the vehicle content information request **188** wherein the vehicle content information request **188** can be a request for the

location of a gas station along the route of the mobile vehicle **170**. The mobility aware content server **50** then transmits to the mobile vehicle **170** a message including the location specific content **60** that can be the gas stations corresponding to the vehicle current location **174**, the vehicle speed **176**, and the vehicle direction **178**. Similarly, the vehicle wireless communication device **171** can transmit the vehicle content request **186** in response to the vehicle temperature **180** being too high or the vehicle engine status **184** indicating a problem with the engine. The location specific content **60** sent from the mobility aware content server **50** can include the location of a repair station based on the vehicle current location **174**, the vehicle speed **176**, and the vehicle direction **178**. One skilled in the art will recognize that the vehicle wireless communication device **171** and the mobility aware content server **50** in accordance with the present invention supports the analysis and communication of associated location specific content for any of the vehicle status indicators as described above or an equivalent.

Although the invention has been described in terms of preferred embodiments, it will be obvious to those skilled in the art that various alterations and modifications may be made without departing from the invention. Accordingly, it is intended that all such alterations and modifications be considered as within the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

CLAIMS

1. A communication management system for personalized mobility management of wireless services, wherein the communication management system, comprises:

at least one wireless communication device; and

a mobility aware content server, wherein the mobility aware content server sends a location specific content to a wireless communication system in response to a current location, a movement speed, and a movement direction of movement of the wireless communication device; and

a wireless communication system, coupled to the mobility aware content server, wherein the wireless communication system, upon receipt of the location specific content from the mobility aware content server, transmits the location specific content to the wireless communication device.

2. A communication management system for personalized mobility management of wireless services as recited in Claim 1, wherein the wireless communication device comprises:

a first device antenna, wherein the first device antenna receives a message from the wireless communication system;

a device receiver coupled to the first device antenna for receiving the communication signals transmitted by the wireless communication system;

a device processor coupled to the device receiver, for processing received messages;

a device memory coupled to the device processor, wherein the device processor stores the message in the device memory;

a device transmitter coupled to the device processor, wherein the device transmitter sends a signal such as an uplink message in response to a command from the device processor.

3. A communication management system for personalized mobility management of wireless services as recited in Claim 2, wherein the wireless communication device further comprises:

a global positioning satellite antenna; and

a global positioning satellite receiver coupled to the global positioning satellite antenna, wherein the global positioning satellite receiver receives a plurality of signals via the GPS antenna corresponding to a current location of the wireless communication device.

4. A communication management system for personalized mobility management of wireless services, wherein the mobility aware content server comprises:

a first server antenna, wherein the first server antenna receives a server input from the wireless communication system;

a server receiver coupled to the first server antenna, wherein the server receiver demodulates the received server input;

a server processor coupled to the server receiver for processing the received server input;

a server content memory coupled to the server processor, for storing a plurality of content information including a location specific content information;

a server user memory coupled to the server processor, for storing a location information for a plurality of device users,

wherein the server processor is programmed to calculate a first user content location using the plurality of locations for a first user, and further wherein the first user content location is stored in the server user memory, and further wherein the server processor determines the location specific content to send in response to a content request by matching the first user content location with the plurality of content information;

a second server antenna; and

a server transmitter coupled to the second server antenna and further coupled to the server processor, for sending the location specific content via the second server antenna to the wireless communication device in response to a command from the server processor.

5. Within a mobility content server of a communication management system comprising a wireless communication system, at least one wireless communication device, and the mobility content server, wherein the mobility content server includes a content memory for storing a plurality of content information and a user memory for storing a plurality of user locations, a method for personalized mobility management of wireless services comprising:

receiving a server input including a location information for a first user from the wireless communication system;

storing the location information for the first user in the server user in one of the plurality of locations for the first user;

calculating a first user content location using the plurality of locations for the first user;

storing the first user content location in the server user memory; and

identifying the location specific content associated with the first user in response to a content request from the first user by matching the first user content location with the plurality of content information in the content memory.

6. Within a mobility content server of a communication management system comprising a wireless communication system, at least one wireless communication device, and the mobility content server, wherein the mobility content server includes a content memory for storing a plurality of content information and a user memory for storing a plurality of user locations, a method for personalized mobility management of wireless services comprising:

receiving a server input including a content request from a device user from the wireless communication system;

identifying a required content information for the device user;

accessing server content memory to obtain the content information which is preferably a location specific content; and

sending the content information such as the location specific content to the wireless communication system.

7. A location protocol for use within a communication management system for personalized mobility management of wireless services, wherein the communication management system comprises a wireless communication system, at least on wireless communication device, and a mobility aware content server, the location protocol comprising:

an address, wherein the address is a unique selective call address assigned to the wireless communication device in the wireless communication system;

a location control code, wherein the location control code is a unique control code indicating that a location information for the wireless communication device follows; and

the location information, wherein the location information comprises:

the current location,

the movement speed, and

the movement direction.

8. A content protocol for use within a communication management system for personalized mobility management of wireless services, wherein the communication management system comprises a wireless communication system, at least on wireless communication device, and a mobility aware content server, the content protocol comprising:

an address, wherein the address is a unique selective call address assigned to the wireless communication device in the wireless communication system;

a content control code, wherein the content control code is a unique control code indicating that the message being communicated relates to a location specific content for the wireless communication device;

a content request flag, wherein the content request flag identifies that a request for content information has been enabled;

a content attached flag, wherein the content attached flag identifies that the location specific content follows in the message; and

the location specific content.

9. A mobile vehicle for use within a communication management system for personalized mobility management of wireless services, wherein the communication management system comprises a wireless communication system, at least on wireless communication device, and a mobility aware content server, the mobile vehicle comprising:

a vehicle wireless communication device;

a vehicle address, wherein the vehicle address is a unique selective call address in the wireless communication system;

a plurality of vehicle status indicators coupled to the wireless communication device;

wherein the vehicle wireless communication device analyzes the plurality of vehicle status indicators and responds thereto by transmitting a message including a vehicle content request to the mobility aware content server.

10. A mobile vehicle for use within a communication management system for personalized mobility management of wireless services as recited in Claim 8, wherein the vehicle content request comprises:

a vehicle address;

a vehicle current location;

a vehicle speed;

a vehicle direction; and

a vehicle content information request, wherein the mobile vehicle receives a message including the location specific content from the mobility aware content server based on the vehicle current location, the vehicle speed, and the vehicle direction in response to the vehicle content request.

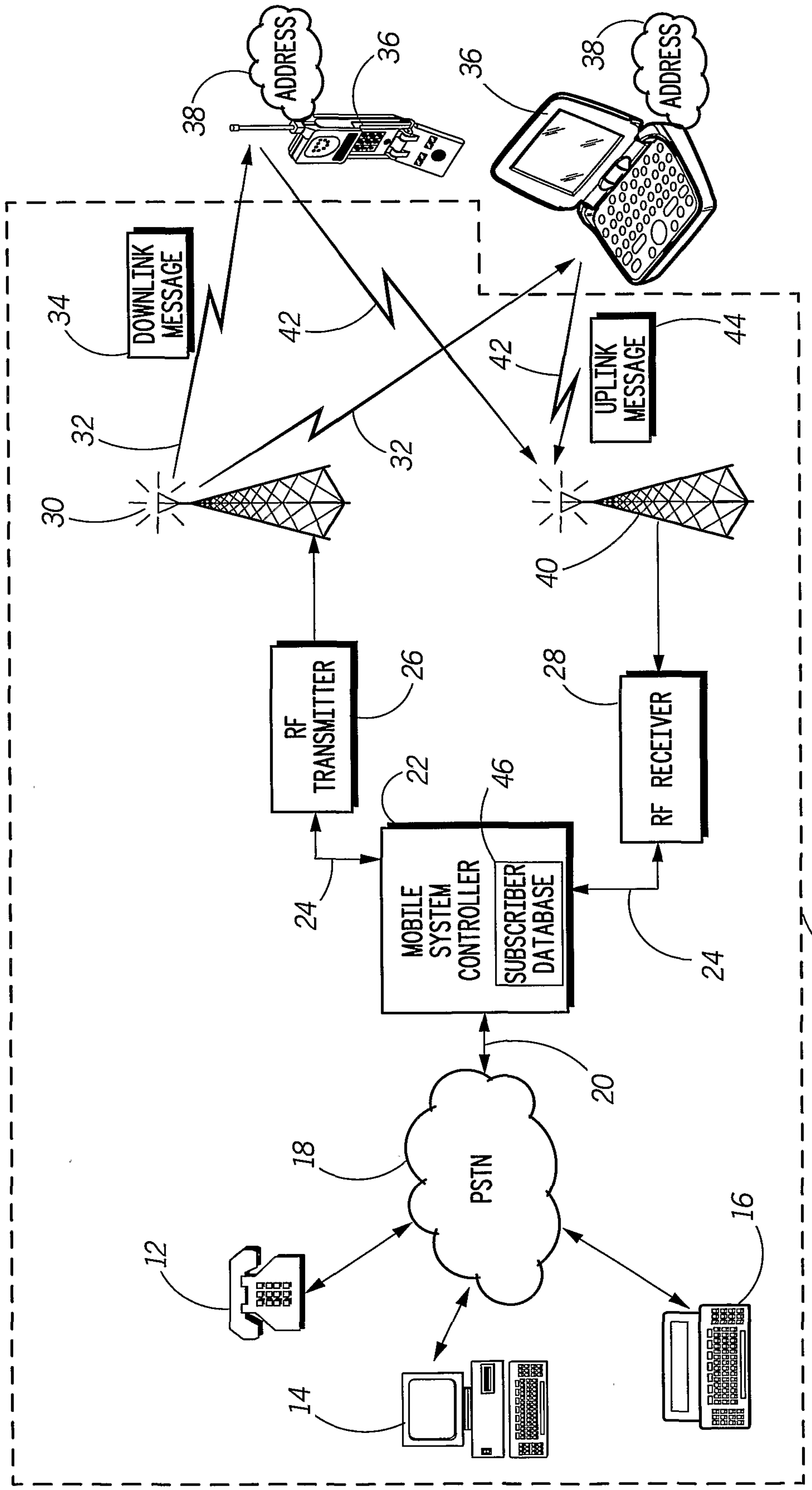

ADDRESS
38
36
ADDRESS
38
36
DOWNLINK MESSAGE
34
42
42
UPLINK MESSAGE
44
32
32
30
40
RF TRANSMITTER
26
RF RECEIVER
28
22
46
MOBILE SYSTEM CONTROLLER
SUBSCRIBER DATABASE
24
24
20
PSTN
18
12
14
16
10

FIG. 1

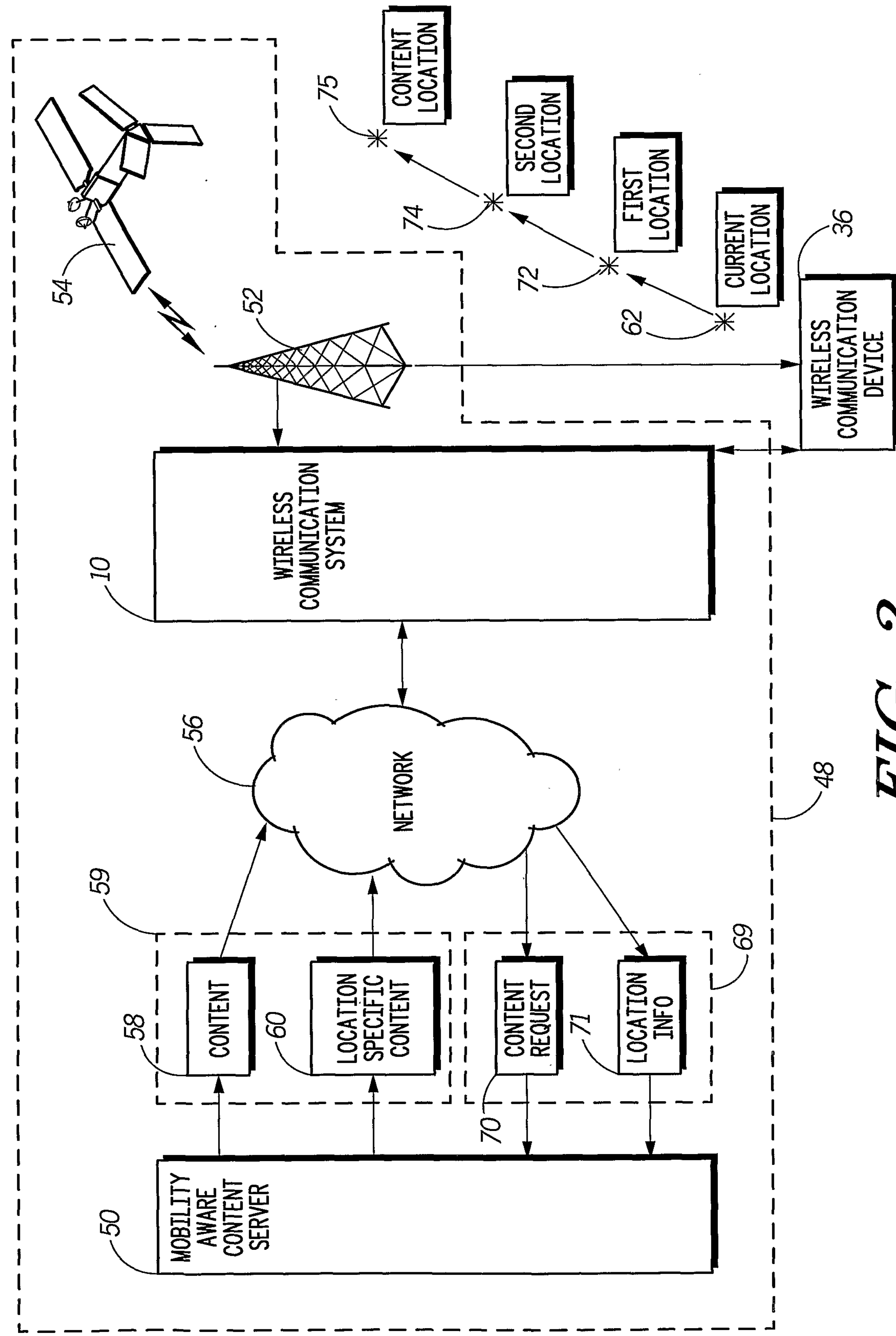

CONTENT LOCATION
75
SECOND LOCATION
74
FIRST LOCATION
72
CURRENT LOCATION
62
36
WIRELESS COMMUNICATION DEVICE
54
52
WIRELESS COMMUNICATION SYSTEM
10
NETWORK
56
48
59
CONTENT
58
LOCATION SPECIFIC CONTENT
60
CONTENT REQUEST
70
LOCATION INFO
71
69
MOBILITY AWARE CONTENT SERVER
50

FIG. 2

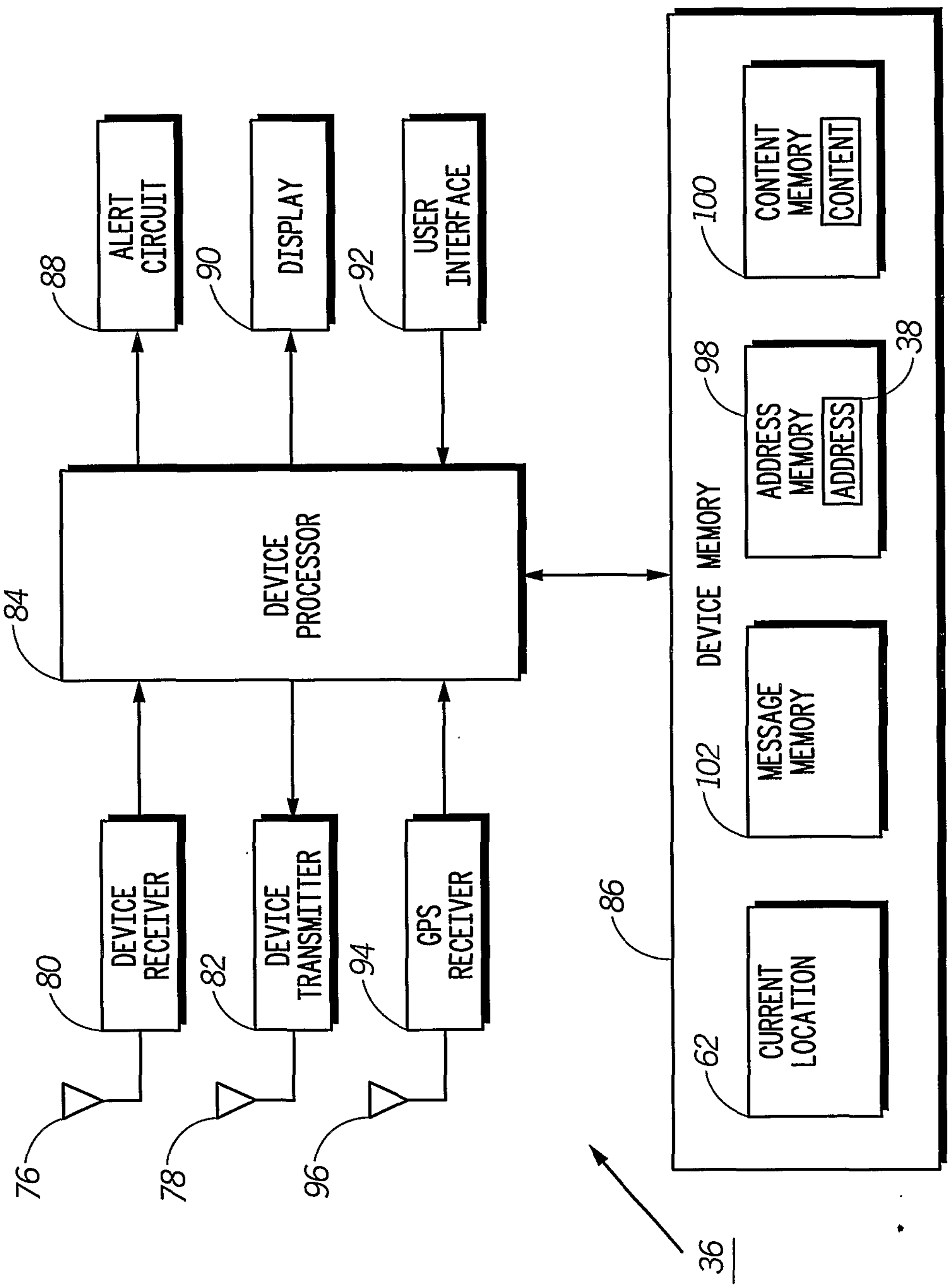

DEVICE RECEIVER
DEVICE TRANSMITTER
GPS RECEIVER
DEVICE PROCESSOR
ALERT CIRCUIT
DISPLAY
USER INTERFACE
DEVICE MEMORY
CURRENT LOCATION
MESSAGE MEMORY
ADDRESS MEMORY
ADDRESS
CONTENT MEMORY
CONTENT
76
78
96
80
82
94
84
88
90
92
86
62
102
98
38
100
36

FIG. 3

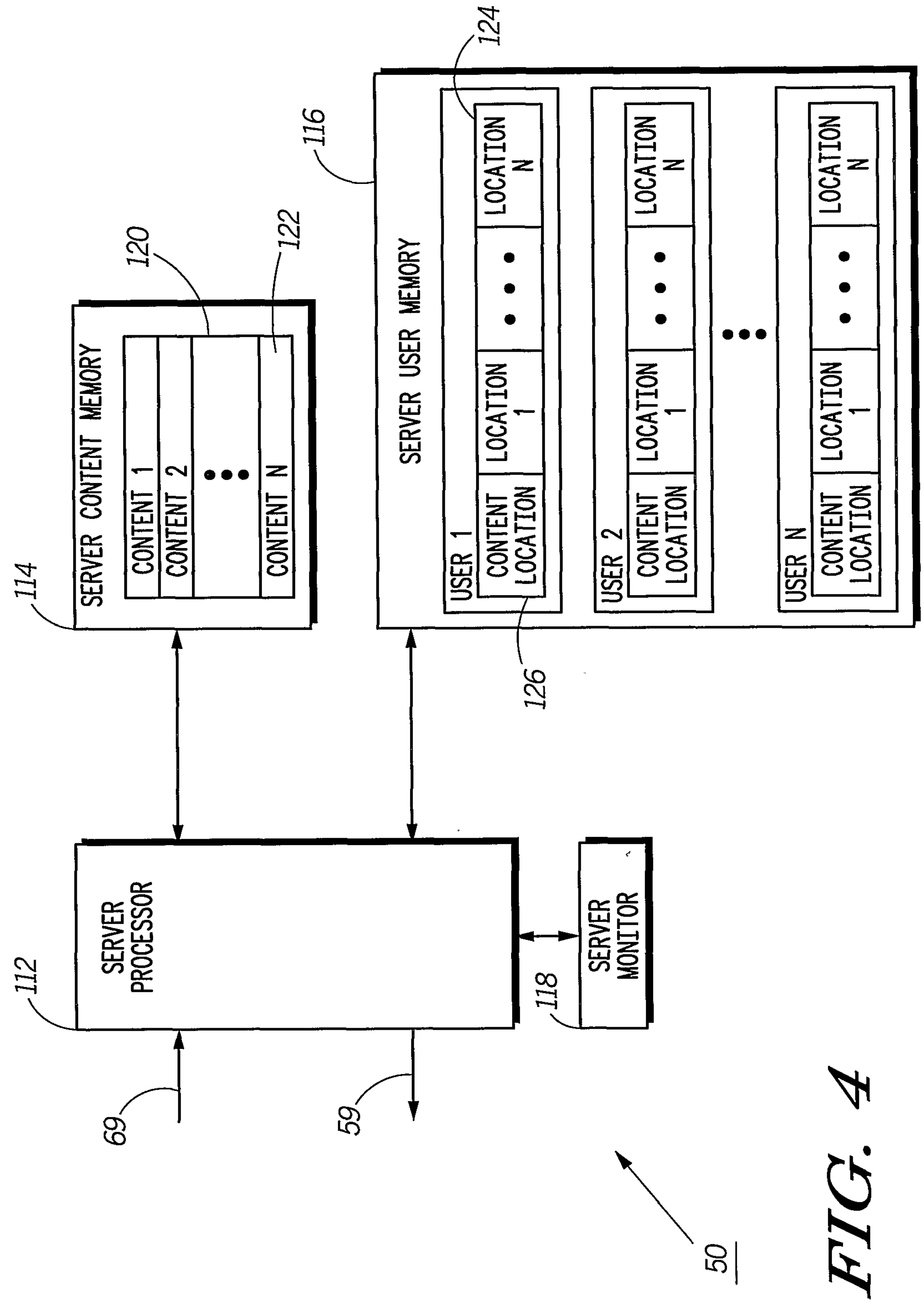

SERVER PROCESSOR
112
69
59
SERVER MONITOR
118
SERVER CONTENT MEMORY
114
CONTENT 1
CONTENT 2
CONTENT N
120
122
SERVER USER MEMORY
116
USER 1
USER 2
USER N
CONTENT LOCATION
LOCATION 1
LOCATION N
124
126
50

FIG. 4

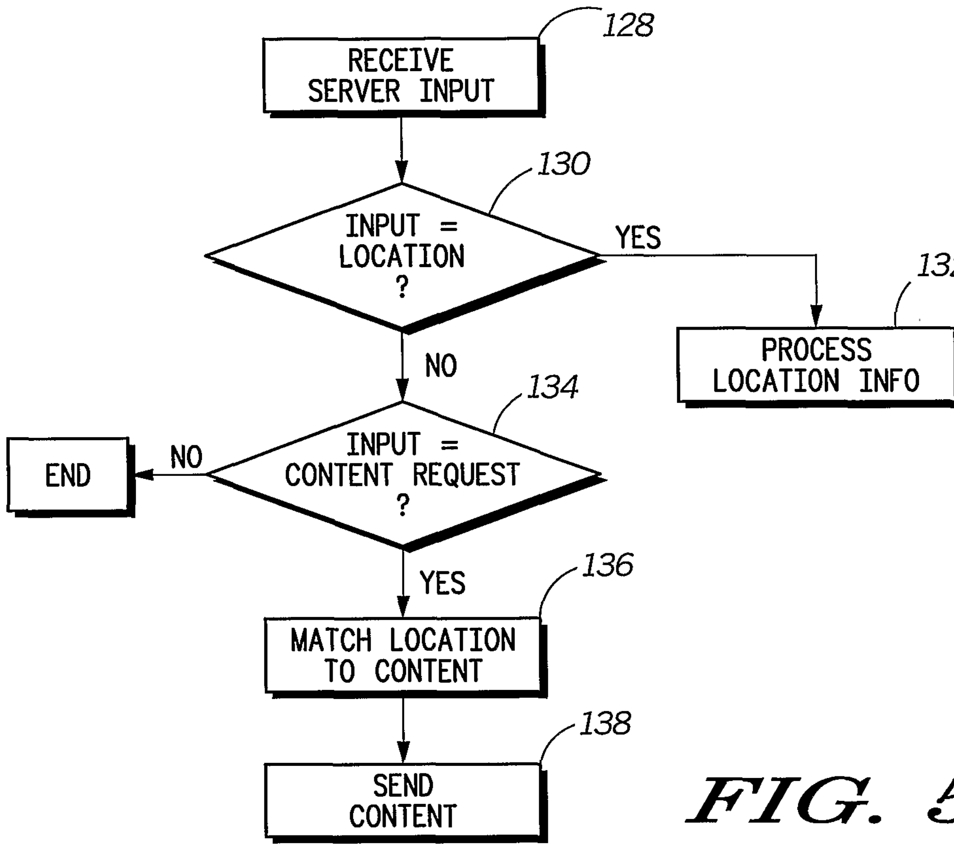


FIG. 5

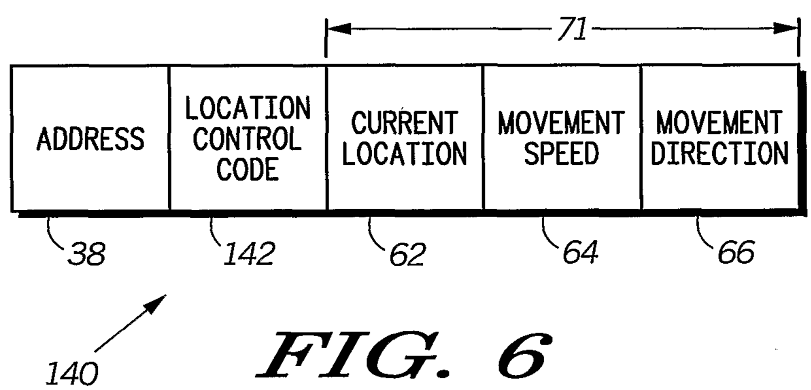


FIG. 6

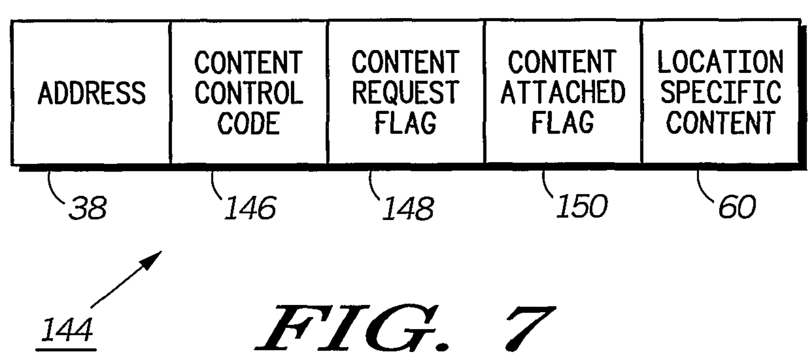
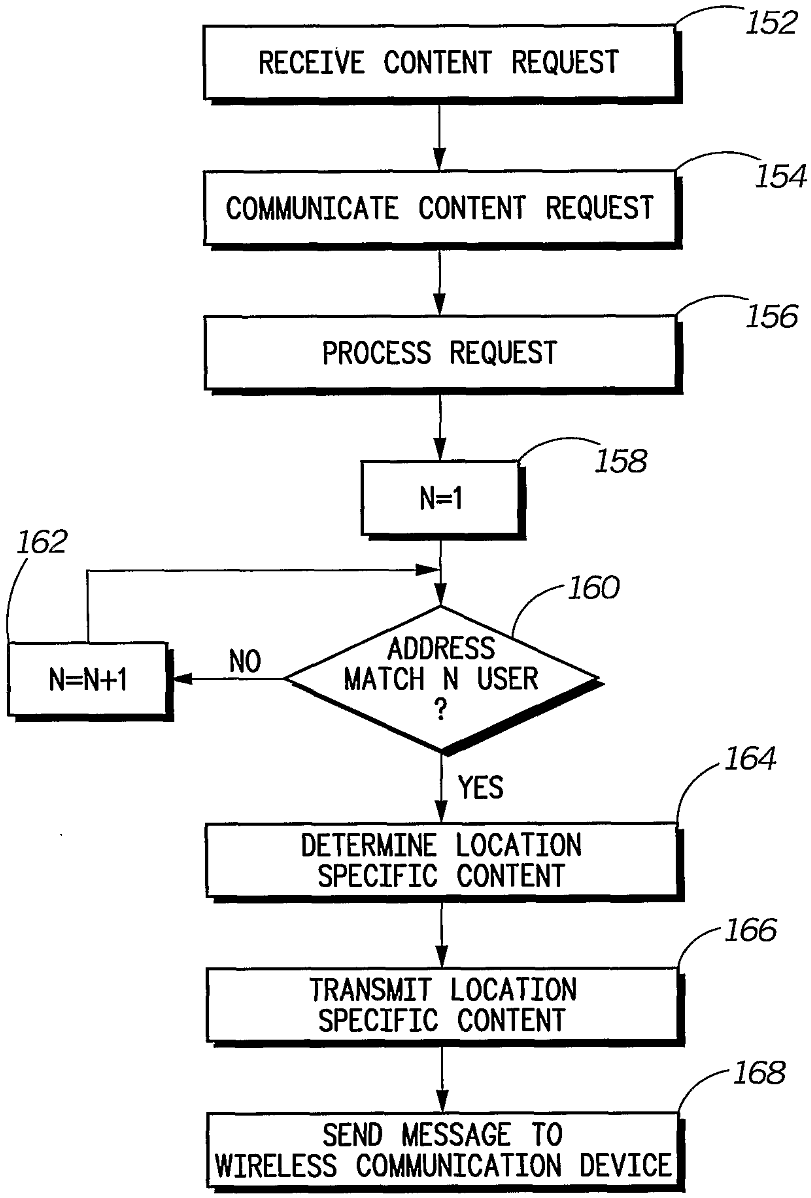


FIG. 7



152
RECEIVE CONTENT REQUEST
154
COMMUNICATE CONTENT REQUEST
156
PROCESS REQUEST
158
N=1
162
160
ADDRESS MATCH N USER ?
NO
N=N+1
YES
164
DETERMINE LOCATION SPECIFIC CONTENT
166
TRANSMIT LOCATION SPECIFIC CONTENT
168
SEND MESSAGE TO WIRELESS COMMUNICATION DEVICE

FIG. 8

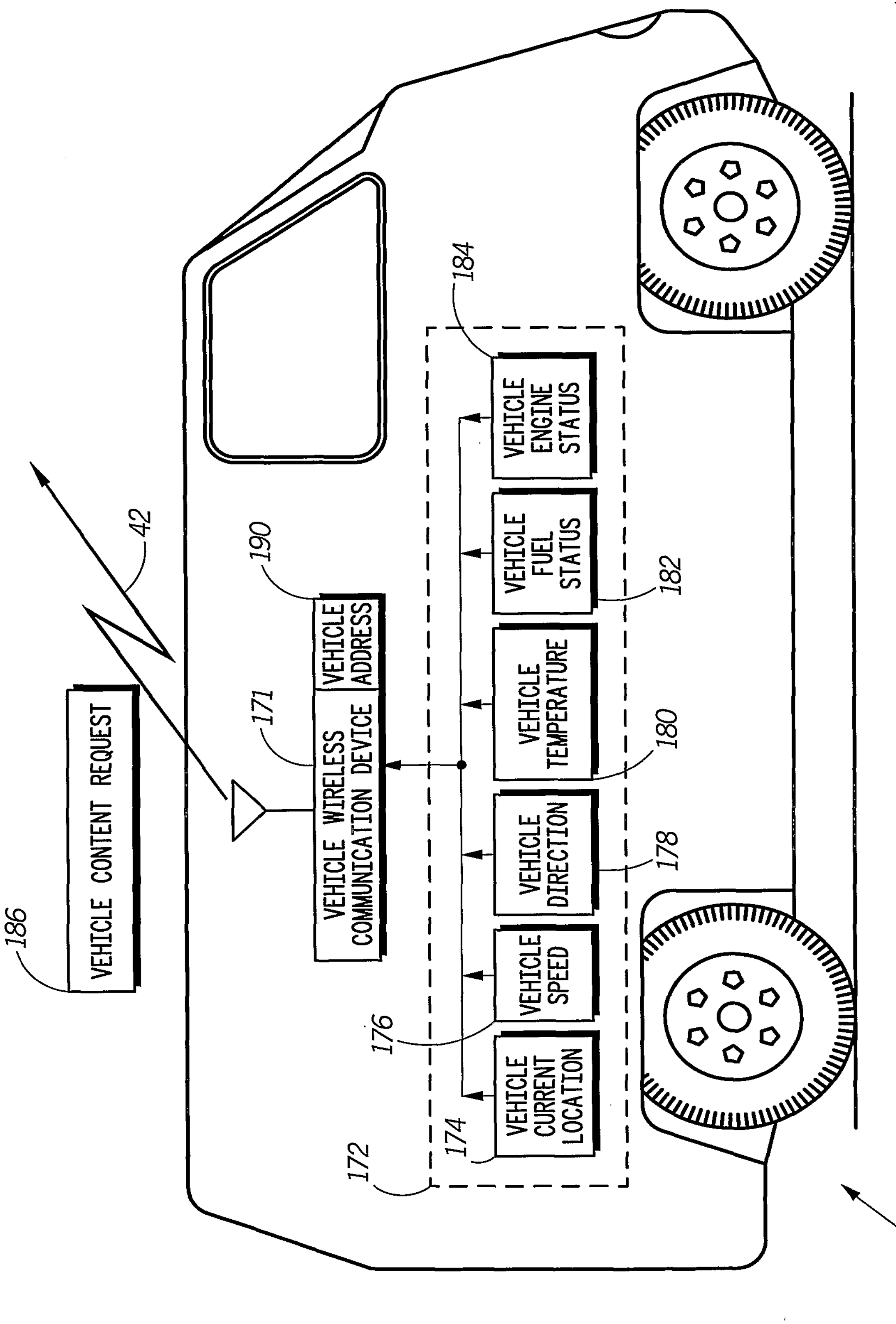

VEHICLE CONTENT REQUEST
186
42
171
VEHICLE WIRELESS COMMUNICATION DEVICE
VEHICLE ADDRESS
190
VEHICLE CURRENT LOCATION
VEHICLE SPEED
VEHICLE DIRECTION
VEHICLE TEMPERATURE
VEHICLE FUEL STATUS
VEHICLE ENGINE STATUS
172
174
176
178
180
182
184
170

FIG. 9

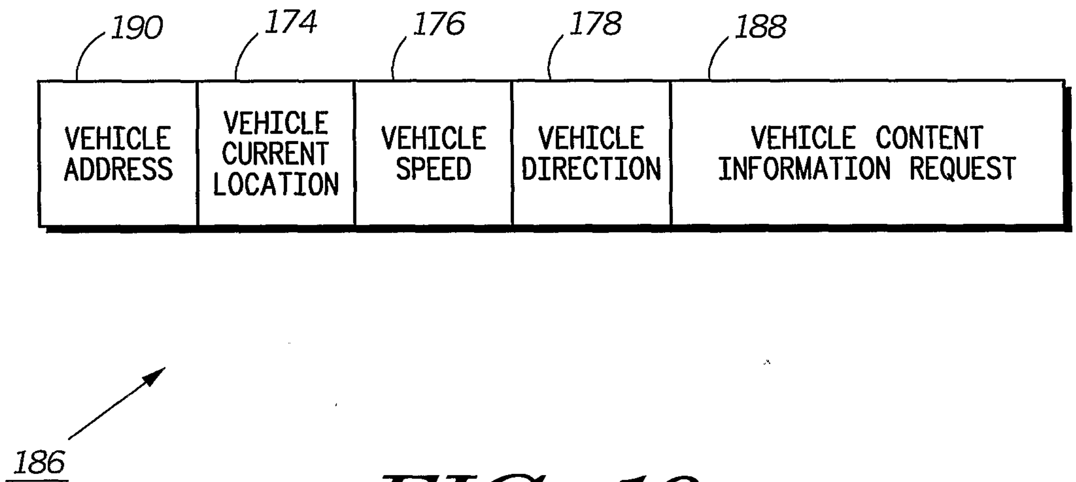

190
174
176
178
188
VEHICLE ADDRESS
VEHICLE CURRENT LOCATION
VEHICLE SPEED
VEHICLE DIRECTION
VEHICLE CONTENT INFORMATION REQUEST
186

FIG. 10